

Preliminary Amendment

Applicant: Jeffery S. Beck et al.

Serial No.: Unknown (Parent Serial No. 09/808,763)

Filed: Herewith (Parent Filing Date March 15, 2001)

Docket No.: 10992120-4

Title: INTEGRATED CONTROL OF POWER DELIVERY TO FIRING RESISTORS FOR PRINthead
ASSEMBLY (As Amended)

IN THE TITLE

Please replace the Title as follows:

**INTEGRATED CONTROL OF POWER DELIVERY TO FIRING
RESISTORS FOR PRINthead ASSEMBLY**

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IN THE SPECIFICATION

Please replace the paragraph beginning at page 1, line 6, with the following rewritten paragraphs:

This Patent Application is a Continuation of U.S. Patent Application Serial No. 09/808,763, filed on March 15, 2001, entitled "INTEGRATED CONTROL OF POWER DELIVERY TO FIRING RESISTORS FOR PRINTHEAD ASSEMBLY," having Attorney Docket No. 10992120-1, and which is herein incorporated by reference.

Also, ~~this Non-Provisional~~ Continuation Patent Application is related to commonly assigned U.S. Patent Application Serial No. 09/253,411, filed on February 19, 1999, entitled "A HIGH PERFORMANCE PRINTING SYSTEM AND PROTOCOL," with Attorney Docket No. 10990391-1, and which is herein incorporated by reference.

Please replace the paragraph beginning at page 1, line 13, with the following rewritten paragraph:

The present invention relates generally to ~~inkjet~~-printheads, and more particularly to controlling power delivery to firing resistors in ~~inkjet~~-printheads.

Please replace the paragraph beginning at page 1, line 25, with the following rewritten paragraph:

Typically, the printhead ejects the ink drops through the nozzles by rapidly heating a small volume of ink located in vaporization chambers with small electric heaters, such as thin film ~~resistors~~resistors. Heating the ink causes the ink to vaporize and be ejected from the nozzles. Typically, for one dot of ink, a remote printhead controller typically located as part of the processing electronics of a printer, controls activation of an electrical current from a power supply external to the printhead. The electrical current is passed through a selected thin film ~~resister~~resistor to heat the ink in a corresponding selected vaporization chamber. The thin film resistors are herein referred to as firing resistors.

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Please replace the paragraph beginning at page 3, line 2 with the following rewritten paragraph:

One aspect of the present invention provides an ~~inkjet~~ printhead including an internal power supply path, a power regulator providing an offset voltage from the internal power supply path voltage, and multiple primitives. Each primitive includes a group of nozzles, a corresponding group of firing ~~resisters~~ resistors, and a corresponding group of switches. The switches are controllable to couple a selected firing ~~resister~~ resistor of the group of firing ~~resisters~~ resistors between the internal power supply path and the offset voltage to thereby permit electrical current to pass through the selected firing ~~resister~~ resistor to cause a corresponding selected nozzle to fire.

Please delete the paragraph beginning at page 3, line 11.

~~—In one embodiment, the power regulator is a linear power regulator. In one embodiment, the power regulator includes a digital to analog converter (DAC), such as a current mode DAC, which is coupled to the internal power supply path. The DAC receives a digital offset command representing a desired offset voltage and provides an analog offset voltage from the internal power supply path voltage. In one embodiment, the power regulator includes a buffer amplifier that receives the analog offset voltage and provides a buffered offset voltage. In one embodiment, the power regulator includes multiple feedback amplifiers corresponding to the multiple primitives. Each feedback amplifier receives the buffered offset voltage and provides the offset voltage to a corresponding primitive.~~

Please delete the paragraph beginning at page 3, line 22.

~~—In one embodiment, each switch includes a field effect transistor (FET).~~

Please delete the paragraph beginning at page 3, line 23.

~~—In one embodiment, the printhead includes an internal power ground. Each feedback amplifier includes a first input coupled to the buffered offset voltage, a second input coupled to the offset voltage, and an output. The power regulator further includes multiple transistors. Each transistor is coupled between the internal power ground and the offset voltage and has a~~

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~~gate coupled to the output of a corresponding feedback amplifier. In one embodiment, each transistor is a FET.~~

Please delete the paragraph beginning at page 3, line 30.

~~In one embodiment, the printhead includes an internal power ground. Each feedback amplifier includes a first input coupled to the buffered offset voltage, a second input coupled to the offset voltage, and an output. Each firing resistor in a primitive includes a first terminal coupled to the internal power supply path and a second terminal. The group of switches in each primitive include subgroups of switches. Each subgroup of switches corresponds to a firing resistor and includes a power transistor, a first switch, and a second switch. The power transistor is coupled between the second terminal of the firing resistor and the internal power ground and has a control gate. The first switch is coupled between the drive line and the control gate of the power transistor. The second switch is coupled between the feedback line and the second terminal of the firing resistor. In one embodiment, the power transistor is a FET.~~

Please replace the paragraph beginning at page 4, line 10, with the following rewritten paragraph:

One aspect of the present invention provides an inkjet printhead assembly including at least one printhead. Each printhead includes an internal power supply path, a power regulator providing an offset voltage from the internal power supply path voltage, and multiple primitives. Each primitive includes a group of nozzles, a corresponding group of firing ~~resistors~~resistors, and a corresponding group of switches. The switches are controllable to couple a selected firing ~~resistor~~resistor of the group of firing ~~resistors~~resistors between the internal power supply path and the offset voltage to thereby permit electrical current to pass through the selected firing ~~resistor~~resistor to cause a corresponding selected nozzle to fire.

Please delete the paragraph beginning at page 4, line 20.

~~In one embodiment, the printhead assembly includes multiple printheads.~~

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Please delete the paragraph beginning at page 4, line 21.

~~One aspect of the present invention provides an inkjet printing system including a first power supply and at least one printhead. Each printhead includes an internal power supply path coupled to the first power supply, a power regulator providing an offset voltage from the internal power supply path voltage, and multiple primitives. Each primitive includes a group of nozzles, a corresponding group of firing resistors, and a corresponding group of switches. The switches are controllable to couple a selected firing resistor of the group of firing resistors between the internal power supply path and the offset voltage to thereby permit electrical current to pass through the selected firing resistor to cause a corresponding selected nozzle to fire.~~

Please delete the paragraph beginning at page 4, line 31.

~~In one embodiment, the printhead includes a processor supplying the digital offset command. In another embodiment, the inkjet printing system includes an electronic controller supplying the digital offset command to the printhead.~~

Please replace the paragraph beginning at page 5, line 3, with the following rewritten paragraph:

One aspect of the present invention provides a method of ~~inkjet printing inoperating~~ an inkjet printhead. The method provides an internal power supply path and provides an offset voltage from the internal power supply path voltage. The method couples a selected firing resistor~~resistor~~ of a group of firing resistors~~resistors~~ between the internal power supply path and the offset voltage to cause electrical current to pass through the selected firing resistor~~resistor~~ to cause a corresponding selected nozzle to fire.

Please delete the paragraph beginning at page 5, line 10.

~~In one embodiment, the method includes converting a digital offset command representing a desired offset voltage to an analog offset voltage from the internal power supply path voltage. In one embodiment, the method includes buffering the analog offset voltage. In one embodiment, the method includes receiving the buffered analog offset~~

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~~voltage at a feedback amplifier, and providing the offset voltage with the feedback amplifier.~~

~~In one embodiment, the method includes supplying the digital offset command.~~

Please delete the paragraph beginning at page 5, line 17.

~~—The integrated control of power delivery to the firing resistors in the inkjet printhead according to the present invention permits a fixed applied power to the energized firing resistors and a fixed duration for which the applied power is applied to the energized firing resistors. The integrated control of power delivery to the firing resistors according to the present invention maintains a substantially constant amount of power delivered to the firing resistors, even when only a few firing resistors are energized at a given time. The reduced power variation increases the firing resistor life, which thereby yields a longer life for the printhead according to the present invention.~~

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IN THE ABSTRACT

Please replace the paragraph beginning at page 25, line 6, with the following rewritten paragraph:

An ~~inkjet~~ printhead assembly includes at least one ~~inkjet~~-printhead -having an internal power supply path, a power regulator providing an offset voltage from the internal power supply path voltage, and multiple primitives. Each primitive includes a group of nozzles, a corresponding group of firing ~~resisters~~resistors, and a corresponding group of switches. The switches are controllable to couple a selected firing ~~resister~~resistor between the internal power supply path and the offset voltage to thereby permit electrical current to pass through the selected firing ~~resister~~resistor to cause a corresponding selected nozzle to fire.